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Bilateral pneumatoceles resulting in spontaneous bilateral pneumothoraces and secondary infection in a previously healthy man with COVID-19

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ABSTRACT

An acute COVID-19 infection can result in cystic lung changes that have a unique presentation and are inherently difficult to manage with or without preexisting conditions. Even though reportedly very few COVID-19 patients develop secondary bacterial infections due to unclear mechanisms, a postviral sequela with typical and atypical organisms can prolong the course of lung damage. The long-term effects of COVID-19 lung damage are still unclear, as the morbidity of the disease process is yet to be fully understood. This report presents a rare complication of COVID pneumonia with bilateral necrotizing pneumatoceles presenting with hemoptysis and bilateral pneumothoraces with positive sputum cultures for *Enterobacter aerogenes* and *Pseudomonas aeruginosa.* It highlights rare complications of COVID-19 requiring multiple hospital admissions and ongoing home oxygen therapy.

KEYWORDS COVID-19 complications; pneumothorax; secondary bacterial infections

Severe acute respiratory syndrome coronavirus 2, the cause of coronavirus disease 2019 (COVID-19), caused more than 141.5 million confirmed cases and 3 million deaths worldwide by April 2021.[1] The most common radiological findings are ground glass opacities; rare findings, including pneumatoceles or pneumothorax, can also be present.[2–4] Other notable complications of COVID-19 pneumonia are secondary infections and superinfections, with variation in reporting of the most common pathogen frequency.[5–7] This report presents a rare complication of COVID-19 pneumonia with bilateral necrotizing pneumatoceles presenting with hemoptysis and bilateral pneumothoraces with positive sputum cultures for *Klebsiella* (formerly *Enterobacter*) *aerogenes* and *Pseudomonas aeruginosa*.

CASE PRESENTATION

A previously healthy 32-year-old firefighter presented to the emergency department with fever, chills, nonproductive cough, and shortness of breath. A COVID-19 polymerase chain reaction test was positive, but he refused hospital admission and was discharged home on supplemental oxygen and a tapering dose of oral methylprednisolone.

He returned 3 days later with oxygen saturations in the low 80s, worsening shortness of breath, myalgias, headache, and diarrhea. His temperature was 99.3 °F, blood pressure 122/79 mm Hg, heart rate 94 beats/minute, and respiratory rate 23 breaths/minute, with pulse oximetry 86% on ambient air. Laboratory results showed a white blood cell count of 5040/mm^3, C-reactive protein of 21 mg/dL, lactate dehydrogenase of 688 units/L, fibrinogen of 719 mg/dL, and D-dimer of 2.5 mcg/mL. Computed tomography (CT) of the chest was negative for pulmonary embolus but revealed typical COVID-19 pneumonia changes *(Figure 1a)*. The patient was placed on an Oxymizer at 15 L to keep his oxygen saturation above 92% and was admitted to the intensive care unit, where he received intravenous (IV) remdesivir

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The authors report no conflict of interest. The patient agreed to use his case as a case report.
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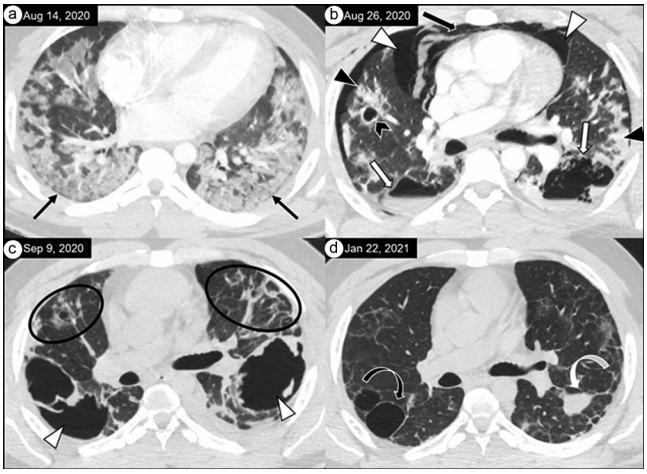

Figure 1. Temporal evolution of chest CT findings in a patient with COVID-19 pneumonia. **(a)** Typical findings of COVID-19 pneumonia showing diffuse, predominantly peripheral, subpleural ground glass opacities (black arrows) in the bilateral lower lobes. **(b)** Multifocal consolidation changes (black arrowheads), early pneumatocele (chevron), large cavities with air fluid levels in bilateral lower lobe superior segments (bold white arrows), bilateral pneumothoraces (white arrowheads), and pneumomediastinum (bold black arrow). **(c)** Further evolution of COVID-19 changes with diffuse interstitial/reticular opacities and architectural distortion (black ovals) and further evolution of bilateral cysts/cavities (white arrowheads). **(d)** CT of the chest 160 days later showing a significant decrease in the size of the cyst in the right lower lobe superior segment (black curved arrow), complete resolution of the cyst with residual opacity in the left lung lower lobe superior segment (white curved arrow), and further improvement in interstitial opacities.

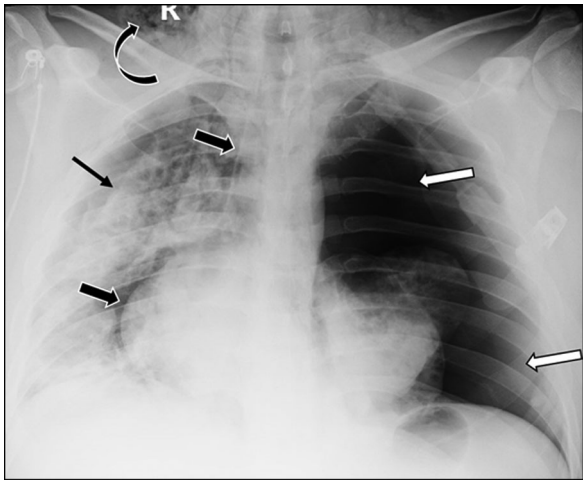

Figure 2. Chest x-ray, anteroposterior view, showing large left tension pneumothorax (white bold arrow) with significant displacement of mediastinum to the right, small right pneumothorax (black arrow), pneumomediastinum (black bold arrows), and subcutaneous emphysema in the lower neck (curved black arrow).

200 mg on day 1 and 100 mg on days 2 to 4; two doses of the anti–IL-6 monoclonal antibody tocilizumab 400 mg IV; dexamethasone 6 mg IV daily; azithromycin 500 mg IV piggyback daily; a unit of COVID-19 convalescent plasma transfusion; and subcutaneous enoxaparin 40 mg every 12 hours. He received azithromycin empirically for atypical community-acquired pneumonia and was discharged home after a 9-day hospital stay on 2 L of oxygen, apixaban, albuterol inhaler, benzonatate, and ergocalciferol.

The patient presented 2 days later with worsening dyspnea, increasing oxygen requirement, and hemoptysis. Chest film revealed a large left tension pneumothorax, small right pneumothorax, pneumomediastinum, and subcutaneous emphysema *(Figure 2)*. He underwent an emergent left thoracostomy tube placement. Subsequent CT scan of the chest showed resolving pneumothoraces, extensive bilateral necrotizing pneumonia with pneumatoceles, and large cysts with air fluid levels *(Figure 1b)*. The sputum culture grew *K. aerogenes* and *P. aeruginosa*; the antimicrobials were narrowed to cefepime. He subsequently underwent two separate left-sided chemical pleurodesis at the bedside with intrapleural doxycycline 4 days apart, as the first attempt resulted only in partial resolution. He was discharged home after a 16-day hospital stay to complete a total of 3 weeks of IV cefepime and was subsequently switched to oral ciprofloxacin for 3 months until near complete radiological resolution of the air fluid levels in the pneumatoceles *(Figure 1c)*. Several months from his initial presentation, the patient is still convalescent at home and requires supplemental oxygen with minimal activity. Repeat CT of the chest during an outpatient visit is shown in *Figure 1d*.

DISCUSSION

Acute or chronic lung infection, mechanical ventilation, lung trauma, or aspiration of certain hydrocarbons can result in pneumatoceles.[8] In COVID-19 pneumonia, late development of multiple pneumatoceles with rupture causing bilateral pneumothoraces, pneumomediastinum, and subcutaneous emphysema is a rare complication, particularly in patients who did not require positive pressure ventilatory support.[9] Lung compliance is severely affected after COVID-19 pneumonia, and patients with lower compliance were found to have higher mortality rates.[5] As seen in our patient, the development of pulmonary necrosis leading to pneumatoceles or cavitary lung lesions can cause hemoptysis, and if disruption of the visceral pleura occurs can result in life-threatening pneumothoraces. About 85% of all patients with pneumatoceles recover spontaneously, whereas some critically ill patients warrant surgical resection.[2,6] Our patient was treated successfully with a prolonged course of IV and oral antimicrobial therapy, consistent with standard treatment recommendations for lung abscess.[7]

In patients with COVID-19 pneumonia, the development of pneumatoceles, ventilator-associated lung injury, or superimposed bacterial infection can lead to life-threatening complications such as hemoptysis, pneumothorax, and pneumomediastinum. The residual sequelae and long-term prognosis of these complications are uncertain.

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Avocations

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